

## CLAIMS

1. A functional molecular element comprising:  
a molecule with permittivity anisotropy and/or a dipole moment;  
a metal ion; and  
a conjugated molecule,  
wherein the molecule with permittivity anisotropy and/or the dipole moment and the conjugated molecule form a complex with the metal ion.
2. A functional molecular element according to Claim 1, wherein the molecule with the permittivity anisotropy and/or the dipole moment is a Lewis base molecule.
3. A functional molecular element according to Claim 1, wherein the metal ion is a Lewis acid.
4. A functional molecular element according to Claim 1, wherein an orientation of the molecule with the permittivity anisotropy and/or the dipole moment is changed by an action of an electric field.
5. A functional molecular element according to Claim 4, wherein conductivity of the conjugated molecule is changed by changing the orientation of the molecule with the permittivity

anisotropy and/or the dipole moment by the action of the electric field.

6. A functional molecular element according to Claim 1, wherein the conjugated molecule is polypyrrole.

7. A functional molecular element according to Claim 1, wherein the molecule with the permittivity anisotropy and/or the dipole moment is 4-pentyl-4'-cyanobiphenyl.

8. A functional molecular element according to Claim 1, wherein the metal ion is a silver ion.

9. A functional molecular element comprising:

a molecule whose  $\pi$  electron conjugated system changes according to a change in molecular structure induced by an electric field; and

a molecule where at least a change in an absorption maximum of an electron absorption spectrum occurs *according to a change in molecular structure induced by the electric field.*

10. A functional molecular element according to Claim 9, that is a functional molecular element according to any of Claims 1 to 8.

11. A functional molecular device, comprising:  
a molecule with permittivity anisotropy and/or a dipole moment;  
a metal ion;  
a conjugated molecule, the molecule with permittivity anisotropy and/or the dipole moment and the conjugated molecule forming a complex with the metal ion;  
an electric field applying means that applies an electric field to the molecule with permittivity anisotropy and/or the dipole moment; and  
an input/output means for the conjugated molecule.

12. A functional molecular device according to Claim 11, wherein the input/output means inputs and outputs electrons.

13. A functional molecular device according to Claim 11, wherein the molecule with permittivity anisotropy and/or the dipole moment is oriented on an electrode for applying the electric field, the metal ion and the conjugated molecule are disposed at least between opposing electrodes, and an output corresponding to the electric field is taken from at least one of the opposing electrodes.

14. A functional molecular device according to Claim 13, wherein a conductive path is formed by the conjugated molecule

and conductivity of the conductive path is controlled by changing the electric field that acts upon the molecule with the permittivity anisotropy and/or the dipole moment.

15. A functional molecular device according to Claim 11, wherein before the electric field is applied, the conductivity of the conductive path is changed by applying a high frequency electric field to the complex.

16. A functional molecular device according to Claim 14, wherein by changing the electric field that acts upon the molecule with permittivity anisotropy and/or the dipole moment, the positional relationship of the molecule with respect to an orientation of the electric field, the angle between the molecule and the conjugated molecule, an *acting position* of the metal ion, or a three-dimensional structure of the complex changes.

17. A functional molecular device according to Claim 14, wherein a layer of the conjugated molecule and a layer of the molecule with permittivity anisotropy and/or the dipole moment form a multilayer structure.

18. A functional molecular device according to Claim 17, wherein

an insulating layer is provided on a first electrode,  
second and third electrodes are formed on the insulating  
layer so as to not contact one another,

the laminated structure is disposed at least between the  
second electrode and the third electrode, and

a fourth electrode is provided directly, or via an  
insulating layer, on the layer of the molecule with permittivity  
anisotropy and/or the dipole moment of the multilayer structure.

19. A functional molecular device comprising:

a molecule whose  $\pi$ -conjugated system changes according to a  
change in molecular structure induced by an electric field;

a molecule where at least a change in an absorption maximum  
of an electron absorption spectrum occurs *according to a change  
in molecular structure induced by the electric field*;

an electric field applying means that applies an electric  
field to a system composed of the molecules; and

an input/output means for the molecule whose  $\pi$ -conjugated  
system changes.

20. A functional molecular device according to Claim 19,  
that is a functional molecular device according to any of Claims  
11 to 18.